BIOASSAYS OF THE GEORGIA-PACIFIC CORPORATION

PALATKA, PUTNAM COUNTY, FLORIDA

NPDES #FL0002763

SAMPLED 7/19/82

Biological Section
Bureau of Water Analysis
September 1, 1982

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EXECUTIVE SUMMARY

Georgia-Pacific Corporation, Palatka, NPDES #FL0002763, on 20 to 22 July, 1982

The sample of wastewater effluent from the pulp and paper mill was not toxic to either Daphnia pulex or to Heterandria formosa. In fact, not a single test organism died in any effluent concentration. However, control mortality in the Daphnia bioassay was sufficient to have invalidated that test at 48 hours.

INTRODUCTION

The Georgia Pacific Pulp and Paper Mill, formerly Hudson Pulp and Paper, is located on State Road 216, approximately 3 miles north of Palatka, Putnam County, Florida (Figure 1). The mill produces approximately 950 tons of paper products per day using an unbleached Kraft and bleached pulp process. Effluent of from 37 to 50 MGD is discharged, with approximately one half of this consisting of process wastewater. Treatment prior to discharge includes primary clarification and 40 days retention in four oxidation ponds. The effluent is aerated in the last pond using several mechanical aerators. Discharge is to Rice Creek, a tributary of the St. Johns River. A schematic of the mill and treatment system is presented in Figure 2.

In 1975 and 1976 the mill was in violation for exceeding its permit limitations for Biochemical Oxygen Demand (BOD) and Total Suspended Solids (TSS). It has also had chronic problems maintaining acceptable levels of dissolved oxygen in the receiving waters (Rice Creek). However, because Rice Creek has a low initial dissolved oxygen concentration, the mill has been granted a variance for this parameter. Additionally, from 5 to 30 MGD groundwater is pumped into Rice Creek to supplement its flow.

The Biological Section had previously performed toxicity bioassays on effluent from this facility, in June, 1981. The results of those tests indicated that the effluent was not toxic to either Daphnia pulex or to Pimephales promelas (FDER 1981).

However, to continue evaluating the effects of this effluent on the biota of the receiving waters, the Biological Section performed additional static acute toxicity bioassays on a grab sample from Outfall #001, on 20 to 22 July, 1982. The results of these latest tests are presented in this report.

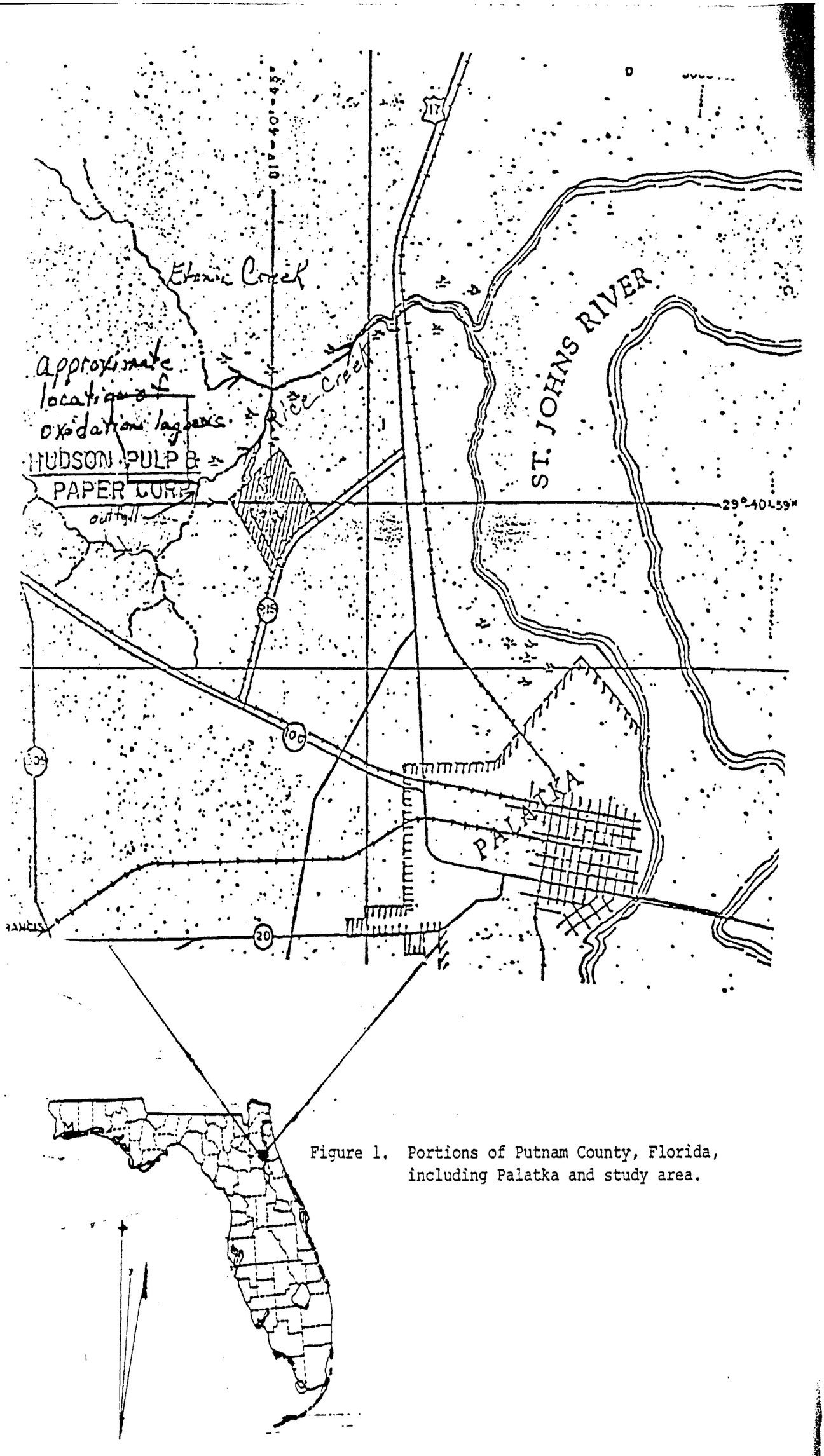
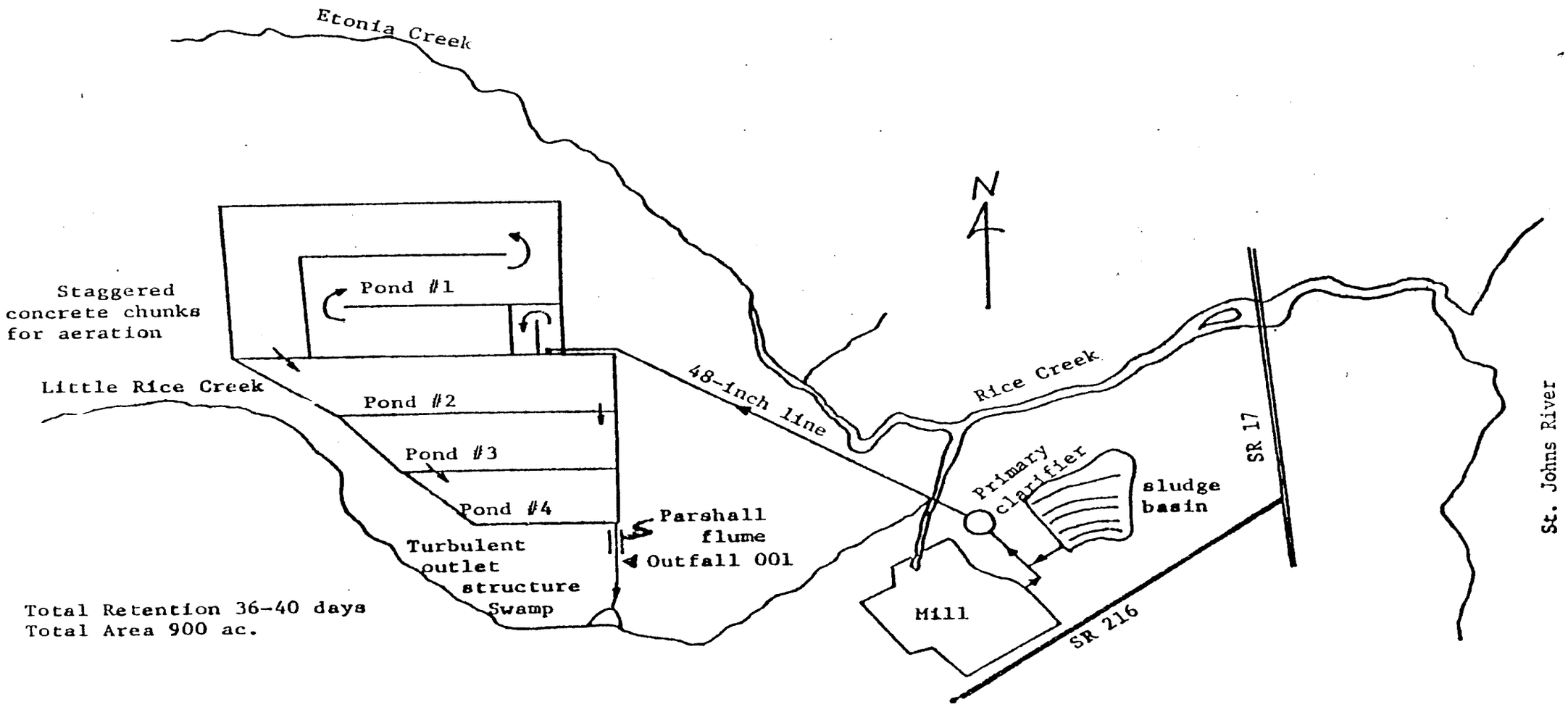


Figure 1. Portions of Putnam County, Florida, including Palatka and study area.

FIGURE 2
Hudson Pulp and Paper Company
Palatka, Florida



METHODS AND MATERIALS

Test methods used to conduct these static bioassays are extensively described by Peltier (1978). The organisms selected for this study include a species recommended by Peltier (1978) and the U.S. EPA (1978). Additionally, the Biological Section maintains cultures of several species of organisms indigenous to the State of Florida. One of these indigenous species was also selected for testing. Life histories of these test organisms and maintenance procedures used to culture them are detailed below.

History and Maintenance of Bioassay Organisms

Daphnia pulex (water flea) - A breeding culture of Daphnia pulex was obtained from the EPA laboratory in Athens, Georgia, in March, 1979. This culture has been maintained since its arrival in 2 1/2 gallon all glass aquaria filled with unchlorinated DER well water, under a 16:8 hour light-dark cycle. Organisms are fed a liquified blend of Purina Trout Chow® and Cerophyl® twice daily, and are kept at a constant temperature of 22° plus or minus 1°C. The aquaria are cleaned weekly by siphoning off half the water along with the detritus and excess organisms. They are then refilled with fresh aerated well water. Additional measures are taken and/or new cultures started in the event of abnormal circumstances such as: declining populations, ephippia formation, or excessive fungal or bacterial growth.

Heterandria formosa (least killifish) - Approximately 100 adult least killifish were obtained from a wild population in the St. Marks Wildlife Refuge (Wakulla County, Florida) during August, 1980. The fish are maintained in two and one-half to 15 gallon all glass aquaria equipped with a flow through water exchange system. Water for this system is unchlorinated and is pumped from a deep well near the DER laboratory. The least killifish are reared at 22° plus or minus 2°C under a 16:8 hour light-dark cycle and are fed freshly hatched Artemia (brine shrimp) twice daily. New born fish are initially maintained in the adult tanks, but are removed at weekly intervals, thereby segregating fish into even age groups. The fish used in this test were 1-3 weeks old.

To ensure the uniform sensitivity of these test organisms to toxic substances, the Biological Section conducts monthly standard reference toxicant bioassays using sodium lauryl sulfate as the reference toxicant.

Test Methods

Two separate 48 hour static acute toxicity bioassays were performed on a sample of effluent collected from Georgia-Pacific's NPDES Outfall. The tests were performed from 1045 hours on 20 July to 1030 hours on 22 July, 1982. The sample was collected by Ms. Teresa Rhodes of DER's Jacksonville Office at 1430 hours on 19 July 1982, using standard wastewater sampling procedures. The sample was iced and transported to the DER laboratory in Tallahassee for analysis within 24 hours of collection.

Freshwater for dilution of the effluent sample was obtained from the same DER deep well that is used to culture the test organisms. The concentration series selected for this study (Table 1) is that recommended by APHA (1980).

Two replicates, each with six concentrations and a control, were used to test with the water flea, Daphnia pulex. Flint glass jars of 250 ml capacity were used as test chambers, and 200 ml of the appropriate test concentration was placed in each chamber. Daphnia were siphoned into a large culture dish to isolate the proper size and age organisms (neonates). To accomplish this, the Daphnia were siphoned through a stainless steel screen. The trapped adults were then discarded. These neonates were then transferred by glass pipette, examined for injury, and were loaded 10 per chamber, resulting in 20 per test concentration. Water fleas were not fed during this test.

Two replicates, of six concentrations and a control, were used for the Heterandria formosa (least killifish) bioassay. The fish were transferred individually or by twos, into wide mouth quart jars containing 500 ml each of the appropriate test concentration, and were loaded 5 per chamber, resulting in 10 per concentration. Fish were not fed during this test.

Dissolved oxygen, pH, temperature, and the number of live organisms were recorded for each test chamber at 0 hours, 24 hours, and 48 hours. Total alkalinity and total hardness were recorded at the beginning of the test for the controls and the 100% effluent concentration. The specific conductance of each test concentration was recorded at the beginning and end of the test. Ammonia concentrations, including total and unionized fractions (expressed in mg/l as N and as NH_3, respectively), were recorded in the controls and the 100% effluent test concentration at the beginning of the test. Total ammonia concentrations were determined using an Orion® specific ion probe and an Orion Ionalyzer®. The unionized fraction was then determined based on the total ammonia concentration, and the pH, temperature, and salinity of the sample. These values were recorded on the bioassay data forms and are presented in Tables 2 and 3.

Table 1. Concentration Series and Volumes Used for These Static Bioassays

Daphnia pulex (water flea)

Concentration	Dilution Water	Effluent	Total Volume
Control	200 ml	---	200 ml
5.6%	188.8 ml	11.2 ml	200 ml
10.0%	180 ml	20 ml	200 ml
18.0%	164 ml	36 ml	200 ml
32.0%	136 ml	64 ml	200 ml
56.0%	88 ml	112 ml	200 ml
100.0%	--	200 ml	200 ml

Heterandria formosa (least killifish)

Concentration	Dilution Water	Effluent	Total Volume
Control	500 ml	---	500 ml
5.6%	472 ml	28 ml	500 ml
10.0%	450 ml	50 ml	500 ml
18.0%	410 ml	90 ml	500 ml
32.0%	340 ml	160 ml	500 ml
56.0%	220 ml	280 ml	500 ml
100.0%	---	500 ml	500 ml

Table 2. Data recorded during 48 hour, Daphnia pulex, static acute toxicity bioassay of Georgia-Pacific Corporation, Palatka, Putnam County, Florida, NPDES #FL0002763, on 20 to 22 July, 1982.

Conc. or %	Number of Live Organisms			Dissolved Oxygen (mg/l)			pH			Total Alkalinity (mg/l as $CaCO_3$)		Total Hardness (mg/l as $CaCO_3$)		Temperature (°C)			NH_3/NH_3+NH_4 (mg/l)		Conductivity (µmhos)	
	0	24	48[a]	0	24	48	0	24	48	0	48	0	48	0	24	48	0	48	0	48
Control	10	10	5	8.6	8.8	8.6	7.8	8.2	8.2	114		122		22.4	21.8	21.4	0/0	---		
Control	10	10	7	8.5	8.8	8.6	7.8	8.2	8.2										202	200
5.6%	10	10	10	8.4	8.5	8.6	7.9	8.2	8.3					22.4	21.6	21.4				
5.6%	10	10	10	8.4	8.5	8.6	7.9	8.2	8.3										250	250
10.0%	10	10	10	8.3	8.4	8.6	7.9	8.2	8.3					22.2	21.5	21.3				
10.0%	10	10	10	8.3	8.4	8.6	7.9	8.2	8.3										300	295
18.0%	10	10	10	8.2	8.2	8.3	7.9	8.3	8.3					22.2	21.5	21.3				
18.0%	10	10	10	8.2	8.2	8.4	7.9	8.3	8.4										375	380
32.0%	10	10	10	7.9	8.2	8.4	7.8	8.3	8.4					21.9	21.5	21.3				
32.0%	10	10	10	7.8	8.1	8.4	7.8	8.3	8.4										490	550
56.0%	10	10	10	7.3	7.8	7.9	7.8	8.3	8.4					21.7	21.5	21.3				
56.0%	10	10	10	7.3	7.8	8.0	7.8	8.3	8.4										780	780
100.0%	10	10	10	6.0	7.2	7.6	7.7	8.3	8.4	279		190		21.1	21.5	21.4	.01/.40	---		
100.0%	10	10	10	5.8	7.3	7.6	7.7	8.3	8.5										1200	1190

Remarks: [a] The 48 hour test is invalidated due to excessive control mortality.

Table 3 . Data recorded during 48 hour, Heterandria formosa, static acute toxicity bioassay of Georgia-Pacific Corporation, Palatka, Putnam County, Florida, NPDES #FL0002763, on 20 to 22 July, 1982.

Conc. or %	Number of Live Organisms			Dissolved Oxygen (mg/ℓ)			pH			Total Alkalinity (mg/ℓ as $CaCO_3$)		Total Hardness (mg/ℓ as $CaCO_3$)		Temperature (°C)			NH_3/NH_3+NH_4 (mg/ℓ)		Conductivity (µmhos)	
	0	24	48	0	24	48	0	24	48	0	48	0	48	0	24	48	0	48	0	48
Control	5	5	5	8.6	7.9	8.4	7.9	8.1	8.2	114		122		22.7	21.5	21.0	0/0	---		
Control	5	5	5	8.6	7.8	7.9	7.9	8.1	8.2										215	215
5.6%	5	5	5	8.3	7.8	7.7	7.9	8.1	8.1					22.6	21.2	21.0				
5.6%	5	5	5	8.3	7.7	7.7	7.9	8.1	8.1										265	265
10.0%	5	5	5	8.3	7.7	7.6	7.9	8.1	8.2					22.4	21.1	20.9				
10.0%	5	5	5	8.3	7.7	7.6	7.9	8.1	8.2										310	310
18.0%	5	5	5	7.9	7.6	7.6	7.8	8.1	8.2					22.1	21.1	20.9				
18.0%	5	5	5	8.0	7.4	7.6	7.8	8.1	8.2										385	385
32.0%	5	5	5	7.6	7.3	7.5	7.8	8.1	8.2					21.8	21.0	20.9				
32.0%	5	5	5	7.6	7.3	7.5	7.8	8.1	8.2										520	550
56.0%	5	5	5	6.6	6.8	7.3	7.8	8.1	8.2					21.4	21.1	20.9				
56.0%	5	5	5	6.7	6.9	7.3	7.8	8.1	8.2										800	800
100.0%	5	5	5	5.4	6.2	6.7	7.7	8.1	8.3	279		190		20.9	21.3	21.0	.01/.40	---		
100.0%	5	5	5	5.3	6.1	6.7	7.7	8.1	8.3										1200	1200

Remarks:

[a] Weight of fish: 12.5 mg each, average of 10 fish.

RESULTS AND DISCUSSION

The sample of wastewater effluent collected from Georgia-Pacific's NPDES Outfall was not toxic to either Daphnia pulex or to Heterandria formosa. In fact, not a single test organism died in any effluent test concentration. However, control mortality in the Daphnia bioassay was sufficient to have invalidated that test at 48 hours.

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